

What we claim is:

1 1. A method of restarting a permanent magnet turbogenerator/motor, comprising the
2 steps of:
3 determining that the permanent magnet turbogenerator/motor has a fatal fault present and
4 is in the process of shutting down;
5 determining that the permanent magnet turbogenerator/motor has more than a fixed
6 number of restart attempts since the permanent magnet turbogenerator/motor was determined to
7 have a fatal fault; and
8 continue shutdown of the permanent magnet turbogenerator/motor.

2. The method of claim 1 wherein the permanent magnet turbogenerator/motor is in a
grid connect mode and said step of determining that the permanent magnet turbogenerator/motor
has a fatal fault present and is in the process of shutting down comprises the steps of:

detecting an over-current condition;
determining that less than a fixed number of over-current events have occurred within a
fixed period of time;
disabling the output power converter of the permanent magnet turbogenerator/motor;
determining that the output current of the permanent magnet turbogenerator/motor is at a
normal level in all phases; and
enabling the output power converter of the permanent magnet turbogenerator/motor to
continue normal operation of the permanent magnet turbogenerator/motor.

3. The method of claim 1 wherein the permanent magnet turbogenerator/motor is in a
grid connect mode and said step of determining that the permanent magnet turbogenerator/motor
has a fatal fault present and is in the process of shutting down comprises the steps of:

4 detecting no output over-current;

5 detecting a loss of output current control or a loss of DC bus voltage control;

6 determining that more than a fixed number of warning faults has occurred within a fixed

7 period of time;

8 reporting a grid fatal fault and initiating shutdown of the permanent magnet

9 turbogenerator/motor.

1 4. The method of claim 1 wherein the permanent magnet turbogenerator/motor is in a
2 grid connect mode and said step of determining that the permanent magnet turbogenerator/motor
3 has a fatal fault present and is in the process of shutting down comprises the steps of:

4 detecting no output over-current;

5 detecting a loss of output current control or a loss of DC bus voltage control;

6 determining that less than a fixed number of warning faults has occurred within a fixed
7 period of time;

8 reporting a grid unbalance warning fault;

9 disabling the output power converter of the permanent magnet turbogenerator/motor;

10 analyzing the grid voltage magnitude and frequency for an acceptable connection; and

11 enabling the output power converter of the permanent magnet turbogenerator/motor to
12 continue normal operation of the permanent magnet turbogenerator/motor.

13 5. The method of claim 1 wherein the permanent magnet turbogenerator/motor is in a
14 grid connect mode and said step of determining that the permanent magnet turbogenerator/motor
15 has a fatal fault present and is in the process of shutting down comprises the steps of:

16 detecting no output over-current;

17 detecting a loss of output current control or a loss of DC bus voltage control;

6 determining that less than a fixed number of warning faults has occurred within a fixed
7 period of time;
8 reporting a grid unbalance warning fault;
9 disabling the output power converter of the permanent magnet turbogenerator/motor;
0 analyzing the grid voltage magnitude and frequency for an unacceptable connection;
1 determining that the maximum allowable reconnection time has expired; and
2 reporting a grid fatal fault and initiating shutdown of the permanent magnet
3 turbogenerator/motor.

1 6. The method of claim 1 wherein the permanent magnet turbogenerator/motor is in a
2 grid connect mode and said step of determining that the permanent magnet turbogenerator/motor
3 has a fatal fault present and is in the process of shutting down comprises the steps of:

4 detecting no output over-current;
5 detecting a loss of output current control or a loss of DC bus voltage control;
6 determining that less than a fixed number of warning faults has occurred within a fixed
7 period of time;
8 reporting a grid unbalance warning fault;
9 disabling the output power converter of the permanent magnet turbogenerator/motor;
0 analyzing the grid voltage magnitude and frequency for an unacceptable connection;
1 determining that the maximum allowable reconnection time has not expired;
2 determining that the DC bus level is below the turn on point of the brake resistor;
3 applying the brake resistor to control DC bus voltage;
4 determining that the grid is acceptable for connection; and

AM-9931

enabling the output power converter of the permanent magnet turbogenerator/motor to
continue normal operation of the permanent magnet turbogenerator/motor.

7. The method of claim 1 wherein the permanent magnet turbogenerator/motor is in a
grid connect mode and said step of determining that the permanent magnet turbogenerator/motor
has a fatal fault present and is in the process of shutting down comprises the steps of:

detecting no output over-current;
detecting a loss of output current control or a loss of DC bus voltage control;
determining that less than a fixed number of warning faults has occurred within a fixed
period of time;
reporting a grid unbalance warning fault;
disabling the output power converter of the permanent magnet turbogenerator/motor;
analyzing the grid voltage magnitude and frequency for an unacceptable connection;
determining that the maximum allowable reconnection time has not expired;
determining that the DC bus level is below the turn on point of the brake resistor;
determining that the grid is acceptable for connection; and
enabling the output power converter of the permanent magnet turbogenerator/motor to
continue normal operation of the permanent magnet turbogenerator/motor.

8. The method of claim 1 wherein the permanent magnet turbogenerator/motor is in a
grid connect mode and said step of determining that the permanent magnet turbogenerator/motor
has a fatal fault present and is in the process of shutting down comprises the steps of:

detecting no output over-current;
detecting a loss of output current control or a loss of DC bus voltage control;

AM-9931

6 determining that less than a fixed number of warning faults has occurred within a fixed
7 period of time;
8 reporting a grid unbalance warning fault;
9 disabling the output power converter of the permanent magnet turbogenerator/motor;
10 analyzing the grid voltage magnitude and frequency for an unacceptable connection;
11 determining that the maximum allowable reconnection time has not expired;
12 determining that the DC bus level is not below the turn on point of the brake resistor;
13 applying the brake resistor to control DC bus voltage;
1 determining that the grid is unacceptable for connection;
determining that the maximum allowable reconnection time has expired; and
reporting a grid fatal fault and initiating shutdown of the permanent magnet
turbogenerator/motor.

9. The method of claim 1 wherein the permanent magnet turbogenerator/motor is in a
grid connect mode and said step of determining that the permanent magnet turbogenerator/motor
has a fatal fault present and is in the process of shutting down comprises the steps of:

detecting an over-current condition;
determining that less than a fixed number of over-current events have occurred within a
6 fixed period of time;
7 disabling the output power converter of the permanent magnet turbogenerator/motor;
8 determining that the output current of the permanent magnet turbogenerator/motor is not
9 at a normal level in all phases;
10 determining that the DC bus level is not below the turn on point of the brake resistor;
11 applying the brake resistor to control DC bus voltage;

AM-9931

12 determining that the output current of the permanent magnet turbogenerator/motor is at a
13 normal level in all phases; and

14 enabling the output power converter of the permanent magnet turbogenerator/motor to
15 continue normal operation of the permanent magnet turbogenerator/motor.

1 10. The method of claim 1 wherein the permanent magnet turbogenerator/motor is in a
2 grid connect mode and said step of determining that the permanent magnet turbogenerator/motor
3 has a fatal fault present and is in the process of shutting down comprises the steps of:

4 detecting an over-current condition;

5 determining that less than a fixed number of over-current events have occurred within a
fixed period of time;

disabling the output power converter of the permanent magnet turbogenerator/motor;

determining that the output current of the permanent magnet turbogenerator/motor is not
at a normal level in all phases;

determining that the DC bus level is below the turn on point of the brake resistor;

determining that the output current of the permanent magnet turbogenerator/motor is at a
normal level in all phases; and

enabling the output power converter of the permanent magnet turbogenerator/motor to
14 continue normal operation of the permanent magnet turbogenerator/motor.

1 11. The method of claim 1 wherein the permanent magnet turbogenerator/motor is in a
2 grid connect mode and said step of determining that the permanent magnet turbogenerator/motor
3 has a fatal fault present and is in the process of shutting down comprises the steps of:

4 detecting an over-current condition;

5 determining that more than a fixed number of over-current events have occurred within a
6 fixed period of time;

7 determining that more than a fixed number of warning faults has occurred within a fixed
8 period of time;

9 reporting a grid fatal fault and initiating shutdown of the permanent magnet
0 turbogenerator/motor.

1 12. The method of claim 1 wherein the permanent magnet turbogenerator/motor is in a
2 standalone mode and said step of determining that the permanent magnet turbogenerator/motor
3 has a fatal fault present and is in the process of shutting down comprises the steps of:

4 detecting an over-current condition;

5 determining that less than a fixed number of over-current events have occurred within a
6 fixed period of time;

7 disabling the output power converter of the permanent magnet turbogenerator/motor;

8 determining that the output current of the permanent magnet turbogenerator/motor is at a
9 normal level in all phases; and

0 enabling the output power converter of the permanent magnet turbogenerator/motor to
1 continue normal operation of the permanent magnet turbogenerator/motor.

2 13. The method of claim 1 wherein the permanent magnet turbogenerator/motor is in a
3 standalone mode and said step of determining that the permanent magnet turbogenerator/motor
4 has a fatal fault present and is in the process of shutting down comprises the steps of:

5 detecting an over-current condition;

6 determining that more than a fixed number of over current events have occurred within a
7 fixed period of time;

determining that less than a fixed number of warning faults has occurred within a fixed period of time;

reporting a grid unbalance warning fault;

disabling the output power converter of the permanent magnet turbogenerator/motor;

resetting the output voltage control ready for a soft start; and

enabling the output power converter of the permanent magnet turbogenerator/motor to continue normal operation of the permanent magnet turbogenerator/motor.

14. The method of claim 1 wherein the permanent magnet turbogenerator/motor is in a standalone mode and said step of determining that the permanent magnet turbogenerator/motor has a fatal fault present and is in the process of shutting down comprises the steps of:

detecting an over-current condition;

determining that less than a fixed number of over-current events have occurred within a fixed period of time;

disabling the output power converter of the permanent magnet turbogenerator/motor;

determining that the output current of the permanent magnet turbogenerator/motor is not at a normal level in all phases;

determining that the DC bus level is below the turn on point of the brake resistor;

determining that the output current of the permanent magnet turbogenerator/motor is at a normal level in all phases; and

enabling the output power converter of the permanent magnet turbogenerator/motor to continue normal operation of the permanent magnet turbogenerator/motor.

1 15. The method of claim 1 wherein the permanent magnet turbogenerator/motor is in a
2 standalone mode and said step of determining that the permanent magnet turbogenerator/motor
3 has a fatal fault present and is in the process of shutting down comprises the steps of:

4 detecting an over-current condition;
5 determining that less than a fixed number of over-current events have occurred within a
6 fixed period of time;
7 disabling the output power converter of the permanent magnet turbogenerator/motor;
8 determining that the output current of the permanent magnet turbogenerator/motor is not
at a normal level in all phases;

 determining that the DC bus level is not below the turn on point of the brake resistor;
 applying the brake resistor to control DC bus voltage;
 determining that the output current of the permanent magnet turbogenerator/motor is at a
normal level in all phases; and

 enabling the output power converter of the permanent magnet turbogenerator/motor to
continue normal operation of the permanent magnet turbogenerator/motor.

16. A method of restarting a permanent magnet turbogenerator/motor, comprising them
steps of:

3 determining that the permanent magnet turbogenerator/motor has a fatal fault present and
4 is in the process of shutting down;

5 determining that the permanent magnet turbogenerator/motor has less than a fixed
6 number of restart attempts since the permanent magnet turbogenerator/motor was determined to
7 have a fatal fault;

AM-9931

determining that the permanent magnet turbogenerator/motor is in a recharge state where an internal energy storage device is being recharged as part of the shutdown process;

determining that a fixed period of time has elapsed since any previous attempt to restart the permanent magnet turbogenerator/motor;

attempt to clear the fault present in the permanent magnet turbogenerator/motor;

issue a restart command to the permanent magnet turbogenerator/motor if the fatal fault is successfully cleared; and

continue normal operation of the permanent magnet turbogenerator/motor.

17. A method of restarting a permanent magnet turbogenerator/motor, comprising them steps of:

determining that the permanent magnet turbogenerator/motor has a fatal fault present and is in the process of shutting down;

determining that the permanent magnet turbogenerator/motor has less than a fixed number of restart attempts since the permanent magnet turbogenerator/motor was determined to have a fatal fault;

determining that the permanent magnet turbogenerator/motor is in a cooldown state where the turbogenerator/motor is being rotated when combustion has ceased to lower the internal temperature as part of the shutdown process and that the internal temperature is below a cooldown restart temperature;

determining that a fixed period of time has elapsed since any previous attempt to restart the permanent magnet turbogenerator/motor;

attempt to clear the fault present in the permanent magnet turbogenerator/motor;

AM-9931

issue a restart command to the permanent magnet turbogenerator/motor if the fatal fault is successfully cleared; and

continue normal operation of the permanent magnet turbogenerator/motor.

18. A method of restarting a permanent magnet turbogenerator/motor, comprising them steps of:

determining that the permanent magnet turbogenerator/motor has a fatal fault present and is in the process of shutting down;

determining that the permanent magnet turbogenerator/motor has less than a fixed number of restart attempts since the permanent magnet turbogenerator/motor was determined to have a fatal fault;

determining that the permanent magnet turbogenerator/motor is in a fault state;

determining that a fixed period of time has elapsed since any previous attempt to restart the permanent magnet turbogenerator/motor;

attempt to clear the fault present in the permanent magnet turbogenerator/motor;

issue a restart command to the permanent magnet turbogenerator/motor if the fatal fault is successfully cleared; and

continue normal operation of the permanent magnet turbogenerator/motor.

19. A method of restarting a permanent magnet turbogenerator/motor, comprising them steps of:

determining that the permanent magnet turbogenerator/motor has a fatal fault present and is in the process of shutting down;

AM-9931

determining that the permanent magnet turbogenerator/motor has less than a fixed number of restart attempts since the permanent magnet turbogenerator/motor was determined to have a fatal fault;

determining that the permanent magnet turbogenerator/motor is in a standby state;

issue a restart command to the permanent magnet turbogenerator/motor; and

continue normal operation of the permanent magnet turbogenerator/motor.

20. A method of restarting a permanent magnet turbogenerator/motor, comprising them steps of:

determining that the permanent magnet turbogenerator/motor has a fatal fault present and is in the process of shutting down;

determining that the permanent magnet turbogenerator/motor has less than a fixed number of restart attempts since the permanent magnet turbogenerator/motor was determined to have a fatal fault;

determining that the permanent magnet turbogenerator/motor is in a recharge state where an internal energy storage device is being recharged as part of the shutdown process;

determining that a fixed period of time has not elapsed since any previous attempt to restart the permanent magnet turbogenerator/motor;

continue shutdown of the permanent magnet turbogenerator/motor.

21. A method of restarting a permanent magnet turbogenerator/motor, comprising them steps of:

determining that the permanent magnet turbogenerator/motor has a fatal fault present and is in the process of shutting down;

AM-9931

5 determining that the permanent magnet turbogenerator/motor has less than a fixed
6 number of restart attempts since the permanent magnet turbogenerator/motor was determined to
7 have a fatal fault;

8 determining that the permanent magnet turbogenerator/motor is in a cooldown state
9 where the turbogenerator/motor is being rotated when combustion has ceased to lower the
10 internal temperature as part of the shutdown process and that the internal temperature is below a
11 cooldown restart temperature;

12 determining that a fixed period of time has elapsed since any previous attempt to restart
the permanent magnet turbogenerator/motor;

attempt to clear the fault present in the permanent magnet turbogenerator/motor; and
continue shutdown of the permanent magnet turbogenerator/motor when the fault is not
cleared.

22. A method of restarting a permanent magnet turbogenerator/motor, comprising them
steps of:

determining that the permanent magnet turbogenerator/motor has a fatal fault present and
is in the process of shutting down;

determining that the permanent magnet turbogenerator/motor has less than a fixed
6 number of restart attempts since the permanent magnet turbogenerator/motor was determined to
7 have a fatal fault;

8 determining that the permanent magnet turbogenerator/motor is in a fault state;

9 determining that a fixed period of time has elapsed since any previous attempt to restart
10 the permanent magnet turbogenerator/motor;

11 attempt to clear the fault present in the permanent magnet turbogenerator/motor; and

continue shutdown of the permanent magnet turbogenerator/motor when the fault is not cleared.

23. A method of determining the fault condition of a permanent magnet turbogenerator/motor in a grid connect mode, comprising the steps of:

detecting an over-current condition;

determining that less than a fixed number of over-current events have occurred within a fixed period of time;

disabling the output power converter of the permanent magnet turbogenerator/motor;

determining that the output current of the permanent magnet turbogenerator/motor is at a

normal level in all phases; and

enabling the output power converter of the permanent magnet turbogenerator/motor to

continue normal operation of the permanent magnet turbogenerator/motor.

24. A method of determining the fault condition of a permanent magnet turbogenerator/motor in a grid connect mode, comprising the steps of:

detecting no output over-current;

detecting a loss of output current control or a loss of DC bus voltage control;

determining that more than a fixed number of warning faults has occurred within a fixed period of time;

reporting a grid fatal fault and initiating shutdown of the permanent magnet turbogenerator/motor.

25. A method of determining the fault condition of a permanent magnet turbogenerator/motor in a grid connect mode, comprising the steps of:

detecting no output over-current;

AM-9931

detecting a loss of output current control or a loss of DC bus voltage control;
determining that less than a fixed number of warning faults has occurred within a fixed period of time;

reporting a grid unbalance warning fault;
disabling the output power converter of the permanent magnet turbogenerator/motor;
analyzing the grid voltage magnitude and frequency for an acceptable connection; and
enabling the output power converter of the permanent magnet turbogenerator/motor to continue normal operation of the permanent magnet turbogenerator/motor.

26. A method of determining the fault condition of a permanent magnet turbogenerator/motor in a grid connect mode, comprising the steps of:

detecting no output over-current;
detecting a loss of output current control or a loss of DC bus voltage control;
determining that less than a fixed number of warning faults has occurred within a fixed period of time;

reporting a grid unbalance warning fault;
disabling the output power converter of the permanent magnet turbogenerator/motor;
analyzing the grid voltage magnitude and frequency for an unacceptable connection;
determining that the maximum allowable reconnection time has expired; and
reporting a grid fatal fault and initiating shutdown of the permanent magnet turbogenerator/motor.

27. A method of determining the fault condition of a permanent magnet turbogenerator/motor in a grid connect mode, comprising the steps of:

detecting no output over-current;

AM-9931

4 detecting a loss of output current control or a loss of DC bus voltage control;
5 determining that less than a fixed number of warning faults has occurred within a fixed
6 period of time;
7 reporting a grid unbalance warning fault;
8 disabling the output power converter of the permanent magnet turbogenerator/motor;
9 analyzing the grid voltage magnitude and frequency for an unacceptable connection;
0 determining that the maximum allowable reconnection time has not expired;
1 determining that the DC bus level is not below the turn on point of the brake resistor;
2 applying the brake resistor to control DC bus voltage;
determine that the grid is acceptable for connection; and
enabling the output power converter of the permanent magnet turbogenerator/motor to
continue normal operation of the permanent magnet turbogenerator/motor.

28. A method of determining the fault condition of a permanent magnet
turbogenerator/motor in a grid connect mode, comprising the steps of:

6 detecting no output over-current;
7 detecting a loss of output current control or a loss of DC bus voltage control;
8 determining that less than a fixed number of warning faults has occurred within a fixed
9 period of time;
0 reporting a grid unbalance warning fault;
1 disabling the output power converter of the permanent magnet turbogenerator/motor;
analyzing the grid voltage magnitude and frequency for an unacceptable connection;
determining that the maximum allowable reconnection time has not expired;
determining that the DC bus level is below the turn on point of the brake resistor;

AM-9931

12 determine that the grid is acceptable for connection; and
13 enabling the output power converter of the permanent magnet turbogenerator/motor to
14 continue normal operation of the permanent magnet turbogenerator/motor.

1 29. A method of determining the fault condition of a permanent magnet
2 turbogenerator/motor in a grid connect mode, comprising the steps of:
3 detecting no output over-current;
4 detecting a loss of output current control or a loss of DC bus voltage control;
5 determining that less than a fixed number of warning faults has occurred within a fixed
6 period of time;

reporting a grid unbalance warning fault;
disabling the output power converter of the permanent magnet turbogenerator/motor;
analyzing the grid voltage magnitude and frequency for an unacceptable connection;
determining that the maximum allowable reconnection time has not expired;
determining that the DC bus level is not below the turn on point of the brake resistor;
applying the brake resistor to control DC bus voltage;
determine that the grid is unacceptable for connection;
determining that the maximum allowable reconnection time has expired; and
15 reporting a grid fatal fault and initiating shutdown of the permanent magnet

16 turbogenerator/motor.

1 30. A method of determining the fault condition of a permanent magnet
2 turbogenerator/motor in a grid connect mode, comprising the steps of:
3 detecting an over-current condition;

AM-9931

determining that less than a fixed number of over-current events have occurred within a fixed period of time;

disabling the output power converter of the permanent magnet turbogenerator/motor;

determining that the output current of the permanent magnet turbogenerator/motor is not at a normal level in all phases;

determining that the DC bus level is not below the turn on point of the brake resistor;

applying the brake resistor to control DC bus voltage;

determining that the output current of the permanent magnet turbogenerator/motor is at a normal level in all phases; and

enabling the output power converter of the permanent magnet turbogenerator/motor to continue normal operation of the permanent magnet turbogenerator/motor.

31. A method of determining the fault condition of a permanent magnet turbogenerator/motor in a grid connect mode, comprising the steps of:

detecting an over-current condition;

determining that less than a fixed number of over-current events have occurred within a fixed period of time;

disabling the output power converter of the permanent magnet turbogenerator/motor;

determining that the output current of the permanent magnet turbogenerator/motor is not at a normal level in all phases;

determining that the DC bus level is below the turn on point of the brake resistor;

determining that the output current of the permanent magnet turbogenerator/motor is at a normal level in all phases; and

AM-9931

enabling the output power converter of the permanent magnet turbogenerator/motor to
continue normal operation of the permanent magnet turbogenerator/motor.

32. A method of determining the fault condition of a permanent magnet
turbogenerator/motor in a grid connect mode, comprising the steps of:

detecting an over-current condition;

determining that more than a fixed number of over-current events have occurred within a
fixed period of time;

determining that more than a fixed number of warning faults has occurred within a fixed
period of time;

reporting a grid fatal fault and initiating shutdown of the permanent magnet
turbogenerator/motor.

33. A method of determining the fault condition of a permanent magnet
turbogenerator/motor in a standalone mode, comprising the steps of:

detecting an over-current condition;

determining that less than a fixed number of over-current events have occurred within a
fixed period of time;

disabling the output power converter of the permanent magnet turbogenerator/motor;

determining that the output current of the permanent magnet turbogenerator/motor is at a
normal level in all phases; and

enabling the output power converter of the permanent magnet turbogenerator/motor to
continue normal operation of the permanent magnet turbogenerator/motor.

34. A method of determining the fault condition of a permanent magnet
turbogenerator/motor in a standalone mode, comprising the steps of:

AM-9931

3 detecting an over-current condition;
4 determining that more than a fixed number of over current events have occurred within a
5 fixed period of time;
6 determining that less than a fixed number of warning faults has occurred within a fixed
7 period of time;
8 reporting a grid unbalance warning fault;
9 disabling the output power converter of the permanent magnet turbogenerator/motor;
10 resetting the output voltage control ready for a soft start; and
enabling the output power converter of the permanent magnet turbogenerator/motor to
continue normal operation of the permanent magnet turbogenerator/motor.

35. A method of determining the fault condition of a permanent magnet
turbogenerator/motor in a standalone mode, comprising the steps of:

detecting an over-current condition;
determining that less than a fixed number of over-current events have occurred within a
fixed period of time;
disabling the output power converter of the permanent magnet turbogenerator/motor;
determining that the output current of the permanent magnet turbogenerator/motor is not
at a normal level in all phases;
determining that the DC bus level is below the turn on point of the brake resistor;
determining that the output current of the permanent magnet turbogenerator/motor is at a
normal level in all phases; and
enabling the output power converter of the permanent magnet turbogenerator/motor to
continue normal operation of the permanent magnet turbogenerator/motor.

AM-9931

1 36. A method of determining the fault condition of a permanent magnet

2 turbogenerator/motor in a standalone mode, comprising the steps of:

3 detecting an over-current condition;

4 determining that less than a fixed number of over-current events have occurred within a
5 fixed period of time;

6 disabling the output power converter of the permanent magnet turbogenerator/motor;

7 determining that the output current of the permanent magnet turbogenerator/motor is not
8 at a normal level in all phases;

9 determining that the DC bus level is not below the turn on point of the brake resistor;

10 applying the brake resistor to control DC bus voltage;

11 determining that the output current of the permanent magnet turbogenerator/motor is at a
normal level in all phases; and

12 enabling the output power converter of the permanent magnet turbogenerator/motor to
continue normal operation of the permanent magnet turbogenerator/motor.

13 37. A permanent magnet turbogenerator/motor restarting system, comprising:

14 means for determining that the permanent magnet turbogenerator/motor has a fatal fault
present and is in the process of shutting down;

15 means for determining that the permanent magnet turbogenerator/motor has more than a
16 fixed number of restart attempts since the permanent magnet turbogenerator/motor was
determined to have a fatal fault; and

17 means to continue shutdown of the permanent magnet turbogenerator/motor.

18 38. A permanent magnet turbogenerator/motor restarting system, comprising:

AM-9931

2 means for determining that the permanent magnet turbogenerator/motor has a fatal fault
3 present and is in the process of shutting down;

4 means for determining that the permanent magnet turbogenerator/motor has less than a
5 fixed number of restart attempts since the permanent magnet turbogenerator/motor was
6 determined to have a fatal fault;

7 determining that the permanent magnet turbogenerator/motor is in a recharge state where
8 an internal energy storage device is being recharged as part of the shutdown process;

9 means for determining that a fixed period of time has elapsed since any previous attempt
to restart the permanent magnet turbogenerator/motor;

means to attempt to clear the fault present in the permanent magnet turbogenerator/motor;

means to issue a restart command to the permanent magnet turbogenerator/motor if the
fatal fault is successfully cleared; and

means to continue normal operation of the permanent magnet turbogenerator/motor.

39. A permanent magnet turbogenerator/motor restarting system, comprising:

means for determining that the permanent magnet turbogenerator/motor has a fatal fault
present and is in the process of shutting down;

means for determining that the permanent magnet turbogenerator/motor has less than a
fixed number of restart attempts since the permanent magnet turbogenerator/motor was
determined to have a fatal fault;

means for determining that the permanent magnet turbogenerator/motor is in a cooldown
state where the turbogenerator/motor is being rotated when combustion has ceased to lower the
internal temperature as part of the shutdown process and that the internal temperature is below a
cooldown restart temperature;

AM-9931

means for determining that a fixed period of time has elapsed since any previous attempt

to restart the permanent magnet turbogenerator/motor;

means to attempt to clear the fault present in the permanent magnet turbogenerator/motor;

means to issue a restart command to the permanent magnet turbogenerator/motor if the fatal fault is successfully cleared; and

means to continue normal operation of the permanent magnet turbogenerator/motor.

40. A permanent magnet turbogenerator/motor restarting system, comprising:

means for determining that the permanent magnet turbogenerator/motor has a fatal fault present and is in the process of shutting down;

means for determining that the permanent magnet turbogenerator/motor has less than a fixed number of restart attempts since the permanent magnet turbogenerator/motor was determined to have a fatal fault;

means for determining that the permanent magnet turbogenerator/motor is in a fault state;

means for determining that a fixed period of time has elapsed since any previous attempt to restart the permanent magnet turbogenerator/motor;

means to attempt to clear the fault present in the permanent magnet turbogenerator/motor;

means to issue a restart command to the permanent magnet turbogenerator/motor if the fatal fault is successfully cleared; and

means to continue normal operation of the permanent magnet turbogenerator/motor.

41. A permanent magnet turbogenerator/motor restarting system, comprising:

means for determining that the permanent magnet turbogenerator/motor has a fatal fault present and is in the process of shutting down;

AM-9931

4 means for determining that the permanent magnet turbogenerator/motor has less than a
5 fixed number of restart attempts since the permanent magnet turbogenerator/motor was
6 determined to have a fatal fault;

7 means for determining that the permanent magnet turbogenerator/motor is in a standby
8 state;

9 means to issue a restart command to the permanent magnet turbogenerator/motor; and

10 means to continue normal operation of the permanent magnet turbogenerator/motor.

1 42. A permanent magnet turbogenerator/motor restarting system, comprising:

2 means for determining that the permanent magnet turbogenerator/motor has a fatal fault
present and is in the process of shutting down;

3 means for determining that the permanent magnet turbogenerator/motor has less than a
fixed number of restart attempts since the permanent magnet turbogenerator/motor was
determined to have a fatal fault;

4 determining that the permanent magnet turbogenerator/motor is in a recharge state where
an internal energy storage device is being recharged as part of the shutdown process;

5 means for determining that a fixed period of time has not elapsed since any previous
attempt to restart the permanent magnet turbogenerator/motor;

6 means to continue shutdown of the permanent magnet turbogenerator/motor.

7 43. A permanent magnet turbogenerator/motor restarting system, comprising:

8 means for determining that the permanent magnet turbogenerator/motor has a fatal fault
present and is in the process of shutting down;

means for determining that the permanent magnet turbogenerator/motor has less than a fixed number of restart attempts since the permanent magnet turbogenerator/motor was determined to have a fatal fault;

means for determining that the permanent magnet turbogenerator/motor is in a cooldown state where the turbogenerator/motor is being rotated when combustion has ceased to lower the internal temperature as part of the shutdown process and that the internal temperature is below a cooldown restart temperature;

means for determining that a fixed period of time has elapsed since any previous attempt to restart the permanent magnet turbogenerator/motor;

means to attempt to clear the fault present in the permanent magnet turbogenerator/motor; and

means to continue shutdown of the permanent magnet turbogenerator/motor when the fault is not cleared.

44. A permanent magnet turbogenerator/motor restarting system, comprising:

means for determining that the permanent magnet turbogenerator/motor has a fatal fault present and is in the process of shutting down;

means for determining that the permanent magnet turbogenerator/motor has less than a fixed number of restart attempts since the permanent magnet turbogenerator/motor was determined to have a fatal fault;

means for determining that the permanent magnet turbogenerator/motor is in a fault state;

means for determining that a fixed period of time has elapsed since any previous attempt to restart the permanent magnet turbogenerator/motor;

AM-9931

means to attempt to clear the fault present in the permanent magnet turbogenerator/motor;

and

means to continue shutdown of the permanent magnet turbogenerator/motor when the fault is not cleared.

45. The permanent magnet turbogenerator/motor restarting system of claim 44 wherein said means for determining that the permanent magnet turbogenerator/motor has a fatal fault present and is in the process of shutting down, comprises:

means for detecting no output over-current;

means for detecting a loss of output current control or a loss of DC bus voltage control;

means for determining that less than a fixed number of warning faults has occurred within a fixed period of time;

means for reporting a grid unbalance warning fault;

means for disabling the output power converter of the permanent magnet turbogenerator/motor;

means for analyzing the grid voltage magnitude and frequency for an unacceptable connection;

means for determining that the maximum allowable reconnection time has not expired;

means for determining that the DC bus level is not below the turn on point of the brake resistor;

means for applying the brake resistor to control DC bus voltage;

means for determining that the grid is acceptable for connection; and

AM-9931

18 means for enabling the output power converter of the permanent magnet
19 turbogenerator/motor to continue normal operation of the permanent magnet
20 turbogenerator/motor.

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